distinguishing symbol and name for each of the constituent isotopes of chlorine or bromine, *e.g.* as Dr. Aston has suggested, Cl^{35}, Cl^{37}, Br^{79}, Br^{81}, etc.

This subject was discussed at the recent meeting of the Solvay Institute in Brussels, and the latter alternative appeared to find favour among the majority of the chemists who were present. In this connexion it is of interest to notice that the last occasion on which it became necessary to reconsider the traditional definition of an element arose from the promulgation of Dalton's atomic theory. In his "New System of Chemical Philosophy" (Part I., p. 143) published in 1808, Dalton puts forward the conclusion that "the ultimate particles of all homogeneous bodies are perfectly alike in weight, figure, etc." If this statement be applied to the nucleus atom of Rutherford, it would appear that the atoms of a homogeneous element must be alike both in weight and in the configuration of the protons and electrons of which the atom is composed. Modern investigations have shown that it is possible to find, on one hand, isotopes composed of atoms which possess a like configuration of the planetary electrons in the outer domain of the atoms, but which differ in the weight of the nucleus; on the other hand, isobares are known (*e.g.* Ne^{40} and Ca^{40}) the atoms of which are alike in weight but differ in configuration. It is of course possible that, in the future, atoms may be discovered which are alike both in weight and in the configuration of their planetary electrons, but differ in their radioactive properties as the result of a different arrangement of the protons and electrons in the nucleus, giving rise to a sort of nuclear isomerism. One such case has been suspected amongst radioactive elements; but Prof. Piccard, of Brussels, has suggested that this assumption need not be made if the actinium series of radioactive bodies be assumed to have its origin in an isotope of uranium, instead of in the element which gives rise to the radium series.

On this hypothesis *odd* atomic weights may be assigned to the radio-elements of the actinium series, while retaining *even* atomic weights for those of the radium and thorium series; under these conditions isotopic members of the actinium and radium series would always differ in atomic weight and the occurrence of isobaric isotopes would be impossible. Prof. Piccard states that this conclusion is supported by recent measurements made to test the application to actinium of the Geiger-Nuttall relationship between the penetrating power of the rays and the life of the atoms emitting them. There is therefore at the present time no valid objection in regarding as the criterion of a homogeneous element the fact that its atoms must be alike both in "weight" and in "figure" (as indicated by identical atomic weights and atomic numbers) and using this as a basis in constructing a working definition of the element.

Elementary Pure Mathematics.

(1) *An Introduction to Projective Geometry.* By Prof. L. N. G. Filon. Third edition. Pp. viii + 253. (London: Edward Arnold and Co., n.d.) 7*s.* 6*d.*

(2) *Elementary Analysis.* By Prof. C. M. Jessop. Pp. viii + 175. (Cambridge: At the University Press, 1921.) 6*s.* 6*d.* net.

(3) *The School Algebra (Matriculation Edition).* By A. G. Cracknell. Sixth impression (second edition). Pp. viii + 456 + lxviii. (London: W. B. Clive: University Tutorial Press, Ltd., 1921.) 6*s.* 6*d.*

(4) *A First Book in Algebra.* By Dr. F. Durell and E. E. Arnold. Pp. v+339+xli. (New York and Chicago: C. E. Merrill Co., n.d.) n.p.

(5) *A Second Book in Algebra.* By Dr. F. Durell and E. E. Arnold. Pp. v+330+xliii. (New York and Chicago: C. E. Merrill Co., n.d.) n.p.

(6) *Plane and Solid Geometry.* By Dr. F. Durell and E. E. Arnold. Pp. 503. (New York and Chicago: C. E. Merrill Co., n.d.) n.p.

(7) *Plane Geometry: Practical and Theoretical, Pari Passu.* By V. Le Neve Foster. (Bell's Mathematical Series for Schools and Colleges.) Vol. 1. Pp. xi+229 +xi. Vol. 2. Pp. xii + 230-423 + xi. (London: G. Bell and Sons, Ltd., 1921.) 3*s.* each.

(8) *Plane Geometry for Schools.* By T. A. Beckett and F. E. Robinson. Part 1. Pp. viii+239+v. (London: Rivingtons, 1921.) 5*s.*

(9) *Wightman's Secondary School Mathematical Tables.* Edited by F. Sandon. Pp. 96. (London: Wightman and Co., Ltd., 1921.) 6*d.*

(1) THE fact that a third edition has been issued of Prof. Filon's book on projective geometry is a sufficient indication of its usefulness and merit. There is little to record as regards changes or innovations. One would only like to say that while from chapter 2 onwards the book reads fairly plainly, the first chapter is not at all easy reading. Why need the student be frightened off by such an introduction to a subject full of fascination? If a further edition is called for, perhaps the author could see his way to simplify this chapter and improving the illustrations so as to make it more palatable.

(2) A text-book should avoid two extremes: the tendency, on one hand, to include all possible cases that are likely to arise, and all kinds of questions that an examiner is likely to set; and the danger, on the other hand, of presenting the subject-matter of the book in the form of an almost "bald and uncon-

vincing narrative." Prof. Jessop's "Elementary Analysis" is so short that on occasion it seems to err in the direction of the second extreme. Yet it is a very clear and useful account of what the average student needs to know if he is to benefit by further work, where the calculus and the methods of analytical geometry are required. University courses continue to become more and more inclusive, and many students will be grateful to the author for the brief presentation he offers them. The straight line and circle are discussed in about fifty pages, differential and integral calculus occupy about a hundred, and about twenty pages are devoted to the general equation of the second degree and the properties of the ellipse, parabola, and hyperbola. The last chapter is almost tabloid in character.

(3) This, like the other publications of the University Tutorial Press, seems to be just the book required for "learning up" for an examination. Nothing, apparently, is left to chance, and the student who has mastered its contents should be able to defy any examiner to do his worst. On reading this book one feels inclined to exclaim: Did I know all this when I passed the matriculation examination? For a class text-book a shorter book with more emphasis on principles and less on the examination spectre would be preferable: but for private students—and they are more numerous than many suppose—this book has its obvious advantages. In the second edition chapters have been added on indices and logarithms.

(4) and (5) Elementary mathematics is gradually being released from the burden of manipulative skill and the bogey of the examiner. Students are no longer expected to do jig-saw puzzles with mosaics of simple, square, and double brackets, with pluses and minuses peppered about like the charges in the modern chemist's atom. This release is well symbolised in Messrs. Durell and Arnold's two books on algebra, written for American schools. Each book represents a year's course, developed with skill and knowledge of pedagogical methods. In the first book each chapter is divided into two parts, the first for the beginner in his first half-year, the second for revision during the second half-year. It is doubtful, however, whether revision by complete repetition is an ideal educational process. The second book is in two parts, the second being "a reservoir of extra work for bright pupils." The complete course is very suitable for the standard of matriculation.

(6) Messrs. Durell and Arnold's "Geometry" contains a full and competent account of all the pure geometry that is required by pupils of higher schools. The sequence is reasonable, and the treatment is practical although the book is essentially a course on formal geometry.

The subject-matter comprises the usual plane geometry and a rather extensive course on solid geometry. The sphere is dealt with in some detail, and an interesting feature of the book is the brief account of the properties of spherical triangles as regards congruence and area. This is a very desirable innovation that English books might copy with advantage. Spherical figures are of importance in many branches of knowledge and the student must somehow pick up a little knowledge about them: but, like hydrostatics, spherical trigonometry is a step-child of the modern mathematical teacher.

As the authors use algebraic symbols, it would have been an advantage to introduce numerical trigonometrical methods. The historical sketches are rather dull.

(7) Books on practical geometry usually give constructions for a number of geometrical exercises with little justification, if any. Books on formal geometry aim at giving a systematic and logical course on the subject: occasionally a lapse into real life takes place, but the main object is to build up a structure of reasoning based on a few fundamental notions and postulates. Where the theoretical and practical are combined, one usually has the two more or less dissociated. Mr. Foster's idea is to combine the advantages of both the practical and the formal by working them into an organic whole; he tries to inculcate the geometry of the class-room by means of the observation of outdoor and home life. He has achieved considerable success. The separate formal propositions are reduced to a very small number—and this is an advantage. In the two parts already issued the ordinary plane geometry is covered, up to and including proportionality and similar figures. A third part is promised on solid geometry.

(8) Like Mr. Foster, Messrs. Beckett and Robinson make it their aim to combine deductive with practical geometry. They commence with a number of practical constructions without proofs, even such complicated problems as the drawing of common tangents to two unequal circles. The student is then introduced to notions of area and to solid figures, thus completing the preliminary section. Section I. gives the formal geometry of triangles and parallelograms, with exercises from life, mechanics, and physics. In Section II. are given the properties of circles in formal order, while Section III. deals with areas and Pythagoras's theorem. Cartesian co-ordinates are introduced, contours explained, and a brief course on numerical trigonometry completes the first part. It will be interesting to see the second part. Pythagoras's theorem is too late in the book: the student usually feels quite excited about this theorem, and the sooner he gets excited about

geometry, the better. The gradient is too steep in the trigonometrical portion.

(9) Why does Mr. Sandon use the title "Mathematical Tables"? In reality the booklet seems to be intended as a pocket cyclopædia of much, if not all, knowledge. In 96 small pages we get treatises on arithmetic, algebra, mechanics, calculus—gamma functions are also included—astronomy, insurance, geology, philology, chemistry, earthquakes, the Morse code, the size of wall-paper, ship watches and bells, and Suffolk and Essex measures of butter and cheese, to name only a selection. The book may be useful, but the mathematical portions are hopelessly marred by misprints.

S. BRODETSKY.

Miscellanea Physica.

(1) *La Loi de Newton est la Loi Unique: théorie mécanique de l'Univers.* Par Max Franck. Pp. iv + 158. (Paris: Gauthier-Villars et Cie, 1921.) 12 fr. 50.

(2) *Fluoreszenz und Phosphoreszenz im Lichte der neueren Atomtheorie.* Von P. Pringsheim. Pp. viii + 202. (Berlin: J. Springer, 1921.) England, 144 marks; Germany, 48 marks.

(3) *La Physique théorique nouvelle.* Par Dr. J. Pacotte. Pp. viii + 182. (Paris: Gauthier-Villars et Cie, 1921.) 12 fr. net.

(4) *Mécanismes communs aux phénomènes disparates.* Par Prof. M. Petrovitch. (Nouvelle Collection Scientifique.) Pp. v + 279. (Paris: Félix Alcan, 1921.) 8 fr. net.

(5) *Über Äther und Uräther.* Von P. Lenard. Pp. 56. (Leipzig: S. Hirzel, 1921.) 9 marks.

(6) *Physikalische Rundblicke. Gesammelte Reden und Aufsätze.* Von Max Planck. Pp. iv + 168. (Leipzig: S. Hirzel, 1922.) 60 marks.

(7) *Physique élémentaire et théories modernes.* Par J. Villey. Première Partie, Molécules et Atomes: États d'équilibre et mouvements de la matière (Mécanique, Statique des fluides, Chaleur, Élasticité et Acoustique). Pp. x + 197. (Paris: Gauthier-Villars et Cie, 1921.) 15 fr.

(1) THE following are the first and the last statements in M. Franck's "loi unique." "Tout volume est composée d'une somme de positif qui est son potentiel et de négatif qui est sa masse. . . . Ces variations de potentiel dans l'éther sont elles-mêmes déterminés directement ou indirectement par l'Esprit." This law "nous supposons capable de tout expliquer"—everything, from the origin of the universe, through Boyle's law, to the constitution of electricity. Such books are the despair of the reviewer. If they are frankly denounced as nonsense, a cry is raised about an obscurantist hierarchy impervious to all new ideas; while a careful analysis of them with a view of discovering whether anything valuable is concealed in the tangled mass of verbiage requires an enormous expenditure of time and labour. We announce therefore that we have not read M. Franck's book, and do not intend to read any book which aims at subverting the foundations of physics unless the author tells us, in terms of its language and concepts, exactly in what respect he finds its conclusions unsatisfactory.

(2) At the other extreme in this miscellany is Dr. Pringsheim's monograph. It is a summary of all important work on phosphorescence and fluorescence between 1908 (the date of the summary in Kayser's Spectroscopy) and March 1921, the experiments being interpreted so far as possible according to Lenard's theory modified and expanded in accordance with that of Bohr. The author's name is a sufficient guarantee of excellence, and it is unnecessary to say more than that the work is worthy of his reputation and of the traditions of German book-production. The book has a special and melancholy interest in that it is the product of the author's internment for five years in Australia, whither he had gone to attend the British Association meeting as a guest of the Australian Government. He is naturally bitter about his treatment, and every one must agree that the incident was exceptionally unfortunate; but alas! war is a succession of unfortunate incidents.

(3) Intermediate between these extremes is M. Pacotte's volume, which is "un essai historique, critique et méthodologique" on the new physics. M. Borel in his preface suggests that nobody has the right to criticise an attempt to compress so much matter within 200 pages who is not prepared to perform the task better himself; and we accept his suggestion in so far as we shall make no attempt to discuss whether, in his capacity as historian, M. Pacotte has always traced the true line of development. But criticism and "methodology" imply a point of view, and it is open to any one to suggest that the point of view is mistaken, without falling under M. Borel's ban; for if the point of view is wrong the book is not worth writing. We have no intention of declaring categorically that it is wrong, for science may be viewed from many standpoints, all of which are equally legitimate. But we think it right to indicate that M. Pacotte's standpoint is not that of the average physicist, nor yet that of the average philosopher; both of them will experience some difficulty in understanding what exactly is the task that M. Pacotte is trying to perform. His standpoint is perhaps more nearly that of the mathematician; but if the book is addressed to mathematicians it is surely a defect